ANNUAL REVIEWS

Annual Review of Political Science

Three Faces of Climate Justice

Nives Dolšak[1] and Aseem Prakash[2]

[1]School of Marine and Environmental Affairs, University of Washington, Seattle, Washington, USA

[2]Department of Political Science and Center for Environmental Politics, University of Washington, Seattle, Washington, USA; email: aseem@uw.edu

Annu. Rev. Political Sci. 2022. 25:283–301

First published as a Review in Advance on December 1, 2021

The *Annual Review of Political Science* is online at polisci.annualreviews.org

https://doi.org/10.1146/annurev-polisci-051120-125514

Keywords

climate justice, climate equity, mitigation, adaptation, just transition

Abstract

There is overwhelming consensus about the science of climate change. Climate politics, however, remains volatile, driven by perceptions of injustice, which motivate policy resistance and undermine policy legitimacy. We identify three types of injustice. The first pertains to the uneven exposure to climate change impacts across countries and communities within a country. Socially, politically, and economically disadvantaged communities that have contributed the least to the climate crisis tend to be affected the most. To address climate change and its impacts, countries and subnational units have enacted a range of policies. But even carefully designed mitigation and adaptation policies distribute costs (the second justice dimension) and benefits (the third justice dimension) unevenly across sectors and communities, often reproducing existing inequalities. Climate justice requires paying careful attention to who bears the costs and who gets the benefits of both climate inaction and action.

INTRODUCTION

Climate change is among the most complex political challenges facing humanity. Scientists have assembled an impressive body of knowledge demonstrating that climate change is anthropogenic and that carbon emissions are altering planetary processes on land and in the atmosphere, cryosphere, and oceans. In response, several countries, subnational governments, and major corporations have pledged to reduce carbon emissions to net zero by 2050. But it is less clear whether they can mobilize the political coalition to achieve this goal. A key reason is that decarbonization is impeded by the intertwined challenges of global collective action (Ostrom 2010) and domestic distributional conflicts (Aklin & Mildenberger 2020). Consequently, climate policy is politicized, and political divisions undermine interpersonal and institutional trust, thereby impeding climate action (Smith & Mayer 2018). Moreover, climate action and inaction often reproduce existing economic, political, and social inequalities, fueling the perceptions of injustice. This means that climate change is at the center of major political debates about who gets what, when, and how (Laswell 1936).

Because decarbonization creates a nonexcludable global public good, countries can free ride. Western critics of decarbonization (simplistically) complain that China and India, which have emerged as major carbon emitters, were not subject to mandatory emission reductions under the 1997 Kyoto Protocol. While Western countries race to retire coal-based electric plants, China and India continue to build them. Moreover, decarbonization policies, be they carbon taxes, cap-and-trade, or renewable energy mandates, impose costs on specific sectors and communities, which feel unjustly targeted. They have incentives to mobilize against decarbonization, as evidenced in France's yellow vest protests and the backlash from coal miners and oil and gas workers in the United States and Canada. Because China is the rising global hegemon, climate critics view decarbonization policies not merely as condoning free riding but as actively hurting the domestic working class and redistributing wealth in favor of China.[1]

Unlike mitigation or decarbonization, climate adaptation should not face political opposition because it predominantly creates local public goods and does not suffer from international free riding. There is no "China excuse" (Dolšak & Prakash 2015) to oppose adaptation. Moreover, unlike decarbonization, adaptation does not aim to restructure the economy, invariably hurting specific sectors and industries. Instead, it aims to minimize disruption caused by climate events so that life can go on as usual. While in the Schumpeterian sense mitigation seeks to destroy the fossil fuel economy to create a decarbonized economy, adaptation seeks preservation of the existing way of life. This makes adaptation politically attractive, which is probably why climate scholars have feared that adaptation might undermine efforts toward mitigation (for an opposing view, see Greenhill et al. 2018).

Climate change is already in motion. Even if the world achieves net-zero emission by 2050, adaptation will still be required. Yet, adaptation is not politics-free; it often involves budgetary issues and policy trade-offs, which provoke questions about how to prioritize goals, who benefits, and who loses (Dolšak & Prakash 2018). Not surprisingly, justice issues frame the adaptation debate as well.

Climate justice (CJ) has its intellectual roots in environmental justice (EJ), as discussed in the next section. CJ has procedural and substantive components. The former pertains to processes

[1] Cecil Roberts (2014), the president of United Mine Workers of America, notes: "[I]t's not just that these jobs will be lost, it's that the ability of companies to continue funding pension and retiree health care benefits will be at great risk. . .and why on earth should we be willing to sacrifice the lives and livelihoods of thousands upon thousands of our fellow citizens on the naive bet that current and emerging economic competitors like China, India, Brazil, Russia and others will follow our lead?"

through which climate policies are formulated. Procedurally just processes incorporate informed consent through inclusive public participation and provide access to remedies to correct the harms that policies might impose on citizens (Klinsky & Dowlatabadi 2009, Schlosberg & Collins 2014). This review focuses on substantive CJ, which we conceptualize in terms of observable inequities in the distribution of benefits and costs of climate action and inaction.

What is the benchmark to assess equity?[2] We ask two questions: Are those who have caused the harm shouldering a greater responsibility to reduce current and future emissions? Are climate policies accentuating or reducing existing social, economic, and political inequalities? Following the principle of causal responsibility[3] (which is akin to the "polluter pays" principle), the 1992 United Nations Framework Convention on Climate Change adopted the principle of "shared but differentiated responsibility" to account for the historical emissions of industrialized countries. Beyond emission reductions, causal responsibility (Tessum et al. 2019) could also require compensating actors harmed by climate disruptions; some view this as "climate reparations" (Fruh 2021). This might take the form of decarbonization and adaptation assistance, including the right to emigrate.

We suggest that CJ has three dimensions, covering both climate inaction and climate actions. The first dimension pertains to climate inactions, which disproportionately (in terms of population shares) expose underprivileged communities to climate change impacts (hence climate impacts) such as rising sea levels, prolonged droughts, and extreme weather events' higher frequency and intensity. Barrett (2013) notes that climate change is marked by a double inequity of the negative correlation between the incidence of climate impacts and the responsibility for causing the climate crisis. This takes place both across and within countries. Rich countries that have benefited from fossil fuel–based industrialization have contributed most to the climate crisis. Yet, climate impacts are likely to be felt more in developing countries; some rich countries might even benefit from climate change. This rich–poor divide is also evident within rich countries (and even within cities). Wealthy households, which have benefited from the industrial economy, are more insulated from climate impacts in relation to the underprivileged, especially communities of color. Moreover, even within poor communities, climate change has a gender component. Terry (2009) notes that climate change imposes new burdens on women in the developing world, which affect their physical, social, and economic well-being.

To address climate impacts, governments have formulated climate mitigation and adaptation policies. These policies vary in how they distribute costs and benefits across sectors and communities, thereby creating distributional conflicts that often reproduce existing inequalities (Wilson 1980, Baumol & Oates 1988). Thus, the second CJ dimension focuses on the uneven distribution of costs imposed by mitigation and adaptation policies. Decarbonization requires regulation of the fossil fuel sector, the transportation sector, and energy-intensive industries such as steel and cement. Such regulation imposes costs on, say, coal mining, oil and natural gas, and associated industries in their supply chains, such as pipelines and railways. Carbon taxes hurt the poor, who spend a higher percentage of their household incomes on energy. Cap-and-trade policies

---

[2] There is a vast literature on climate justice and equity. For an excellent summary, we refer the reader to the report of the Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Kolstad et al. 2014).

[3] Some scholars have critiqued the causal responsibility principle (Gosseries 2004, Posner & Weisbach 2010), noting that causal responsibility assumes that actors knowingly or negligently inflicted the harm. Yet, it is not clear how the current generation could be held responsible for the actions of their ancestors. Furthermore, did the ancestors intentionally inflict the harm? Did they understand that burning coal or using petroleum could cause global warming in the future? Were they negligent? Or, does causal responsibility pertain to the strict liability principle (while ancestors are not culpable, the act of burning fossil suffices to make them responsible)?

could direct pollution to poor neighborhoods. International emission trading might shift emissions from developed to developing countries. Renewable energy mandates may increase mining in developing countries and Native American tribal lands and impose pollution, human health, and cultural costs (Sovacool et al. 2020). For adaptation, when governments seek a so-called managed retreat from flood-prone areas, they may disproportionately condemn the properties of poor households. Building codes to enhance resilience could impose a heavy burden on low-income families.

The third CJ dimension focuses on the uneven distribution of benefits of climate policies. Decarbonization is supposed to create the foundations of a new economy. But who benefits? Today's coal miner is not likely to be tomorrow's solar panel installer or turbine technician, because skill sets are often not portable and retooling the workforce is challenging. Relocating to work in a new industry imposes additional costs, both personal and social. Finally, wage levels in new industries may not be comparable, especially if unionization levels are low.

Decarbonization introduces new technologies, but poor households may not be able to afford them. Electric vehicles (EVs) tend to be more expensive than internal combustion engine cars (ICEs). Recharging EVs creates additional equity problems. Because recharging takes several hours, EVs are convenient for those who can install chargers at home (Guo & Kontou 2021). Rooftop solar is also biased in favor of those living in single-family homes. Regarding adaptation policies, cities may invest in climate-proofing richer neighborhoods, given the revenue imperative and the higher political agency of the rich. Governmental assistance for recovery from natural disasters may favor the rich and privileged.

The remainder of this review is divided into three main sections, followed by a conclusion. The next section introduces the first CJ dimension: uneven distribution of climate impacts. We outline the second CJ dimension examining the costs imposed by climate policies in the third section, and the third dimension, focused on the benefits of climate policies, in the fourth section. We conclude in the fifth section, where we identify avenues for future research.

DISTRIBUTION OF CLIMATE IMPACTS

Environmental Justice: Siting-Luring-Vulnerability Framework

The 1968 Memphis Sanitation Workers' Strike was perhaps the first national-level organized protest again environmental injustice (EPA 2017). The 1982 protest against the polychlorinated biphenyl landfill in Warren County, North Carolina, vividly demonstrated the disparities in the location of hazardous facilities which exposed communities of color to health and environmental risks (Bullard 1990, Mohai et al. 2009, Jenkins 2018). Over the years, EJ scholars have examined other disproportionate risks these communities face, ranging from exposure to lead paint, highway traffic, and pesticide drift to the lack of access to clean drinking water (Kraft & Scheberle 1995).

What explains these disparities? Drawing on Harper & Rajan (2007), we propose the siting-luring-vulnerability framework. Hazardous facilities and waste dumps tend to be sited in low-income neighborhoods that face lower regulatory scrutiny and whose residents have little ability to protest (Bullard & Johnson 2000; but see Konisky 2009).[4] This calculus is on display in the siting of oil and gas pipelines as well. Take the case of the Dakota Access Pipeline, whose route

[4]Another dimension of siting is uneven exposure to pollution. For example, Li et al. (2019) find that Black communities (but not Hispanic communities) tend to have a higher exposure to "excess emissions," which pertains to the release of pollutants when facilities are in the process of starting or shutting down or when their equipment malfunctions.

was changed so that it would cross the Missouri River near the Standing Rock Sioux Reservation instead of the city of Bismarck (which is 90% White) (Johnson 2019). Furthermore, lower home prices in pollution-exposed areas lure low-income households. As opposed to firms deliberately placing their facilities in poor neighborhoods, the causality is opposite—although with the same result: Specific communities tend to be exposed more to environmental risks. Finally, even if all communities had comparable exposure to pollution, the poor still tend to be more vulnerable to health risks because of inadequate access to health care and nutrition (Nardone et al. 2020).[5]

EJ drivers operate at the global level as well. The modern industrial system relies on global value chains to procure, process, and produce inputs. In developing countries with lax regulatory laws, these inputs tend to be extracted, processed, or produced in ways that pollute and damage community health (Brunnermeier & Levinson 2004). Although the Basel Convention prohibits international trade in toxic substances, it does not stop companies from locating their facilities in pollution havens. Take the case of highly polluting industries such as shipbreaking, located predominantly in developing countries. Luring and vulnerability issues apply in the same way. Economic compulsions compel poor households to gravitate to low-cost, polluted areas, and these households also have inadequate access to healthcare facilities.

Climate Justice as Environmental Justice

CJ tends to follow EJ's siting-luring-vulnerability template. Climate impacts often have localized effects, disproportionately hurting poor communities. These include rising sea levels, droughts, hurricane activity, heat waves, forest fires, and new diseases (Brooks et al. 2019). Regarding the siting and luring dimensions, urban poor and communities of color have been compelled to live in ecologically vulnerable areas exposed disproportionately to climate impacts. For perspective, while minorities account for approximately 40% of the US population, they account for approximately 67% of the populations of the 10 counties that the National Oceanic and Atmospheric Administration (NOAA 2021) rates as most vulnerable to extreme heat.

Low-income communities are also more vulnerable to climate impacts. Consider the 1995 Chicago heat wave that killed 1,200 people (Semenza et al. 1996), most of whom were elderly, poor, or non-White. Anguelovski et al. (2016) predict that heat-related mortality in US cities will double by the mid- to late twenty-first century. Moreover, there is differential exposure to heat waves even within a given city. Hoffman et al. (2020) find that formerly redlined Black neighborhoods (the ones that the Federal Housing Administration's underwriting manual maps marked in red ink to suggest that they were too risky to receive mortgage insurance) are hotter than the nonredlined neighborhoods, some by nearly 13°F.

Along with income and race, CJ has an important gender dimension, especially in developing countries (Carr & Thomson 2014). Women tend to be responsible for managing activities both within and outside the home, such as tending the fields and managing the livestock. With climate change, many activities demand greater time and effort. Crow & Sultana (2002) note that water collection is a physically demanding and time-consuming task typically undertaken by women. Climate impacts such as droughts and desertification increase water scarcity. While a typical household in an industrialized country expects that potable water will be available when the faucet is turned on, rural women spend long hours fetching water: 17.5 h per week in Senegal, 15.3 h

[5]In some cases, poor communities might support the location of "undesirable" facilities in their communities because of local economic benefits (see Thorpe 2015 on the location of prisons in poor rural areas and Uji et al. 2021 on restarting nuclear plants in Japan in the aftermath of Fukushima).

in Mozambique, 7 h in the Baroda region of India, 14–35 h in Bangladesh (Nelson et al. 2002). Because climate change will accentuate water scarcity, water collection tasks will require more effort.

Climate impacts will disrupt developing countries in another way: creating an out-migration push. Rigaud et al. (2018) estimate that by 2050 the number of climate migrants in Latin America, sub-Saharan Africa, and Southeast Asia will reach 143 million. The justice challenge is that communities that have probably contributed the least to the climate crisis face forcible dislocation. Residents of small Pacific Island countries are vivid examples because rising sea levels will submerge much of their land (Burkett 2011). Where can they go? The literature on public support for climate migrants is in its infancy and suggests mixed results. Helbling (2020) reports that German respondents are more supportive of climate change migrants in relation to economic migrants. Spilker et al. (2020) find that Vietnamese and Kenyan respondents do not view environmental migrants to be more deserving than economic migrants, while Castellano et al. (2021) find that in Bangladesh, a climate hot spot, there is less support for climate migrants in relation to generic migrants.

Per the principle of causal responsibility, developed countries must accept climate migrants (Fruh 2021). But given the political sensitivity of the immigration issue in Western Europe and the United States, international climate migration remains taboo in climate negotiations. Developed-country governments have resisted the demand to provide refugee status to climate migrants under the 1951 Geneva Convention Relating to the Status of Refugees (Ajibade et al. 2020). Another approach is to provide adaptation aid to climate hot spots to help communities enhance their resilience to climate impacts. This will diminish the push factors that compel individuals and families to immigrate (Stanley & Williamson 2021). Here again, developed countries have been lukewarm to the idea of a massive increase in international adaptation aid (climate aid in general, as demonstrated in the continued lack of funding for the Green Climate Fund). More research is needed to explore the extent to which climate aid is hobbled by aid fatigue, which seems to have emerged in the context of international development aid (Gupta 2009). Moreover, xenophobic sentiment in developed countries typically steers the conversation toward enacting anti-immigration laws instead of seeking to enhance resilience abroad.

COSTS IMPOSED BY MITIGATION AND ADAPTATION POLICIES

Carbon Pricing Challenges

In recent years, countries, states, and cities have enacted laws and regulations to compel actors to reduce emissions or enhance climate resilience. Mitigation measures include command-and-control regulations (such as the Clean Power Plan or Renewable Portfolio Standards) and market-based policies such as carbon taxes or cap-and-trade. Because fossil fuels are the bedrock of the industrial economy, mitigation policies hurt fossil fuel communities. Moreover, they increase energy costs which consumers eventually bear. Without countervailing measures such as revenue recycling and just transition, mitigation policies could impose a disproportionate economic burden on underprivileged groups.

Low-income households tend to spend a higher share of their income on energy needs (Gonzalez 2012). Examining community/block-level data, Tong et al. (2021) find that in Tallahassee, Florida, and St. Paul, Minnesota, lower-income communities use 25–60% more energy per square foot in relation to higher-income communities. Even within the lower-income group, communities with a lower share of the White population used more electricity than communities with a higher share of the White population. Because carbon pricing policies increase energy costs, they impose a higher burden (as a share of household income) on the poor than on the rich.

Faced with higher costs, might households switch over to lower-cost alternatives? After all, this logic motivates carbon pricing. The problem is that the poor often do not have viable substitutes. For example, even with higher gas prices, households may not drive less because their neighborhoods are poorly served by public transportation (a substitute for the personal automobile). Moreover, given that the average vehicle life is approximately 12 years (IHS Markit 2020), it is not realistic to expect that higher gas prices will immediately motivate individuals to sell their existing vehicles and switch over to more fuel-efficient ones.

Regressive effects of carbon pricing can be addressed through revenue recycling, that is, returning tax revenues to citizens via tax breaks or using them for a designated purpose such as green infrastructure (Farrell & Lyons 2016), thereby increasing public support for climate mitigation (Dolšak et al. 2020). Take the case of British Columbia, which introduced a carbon tax in 2008. Murray & Rivers (2015) find that revenue recycling corrected the regressive features of the provincial carbon tax by reducing personal income tax (especially for lower-income households) and providing income tax credits. Furthermore, it provided direct transfers to rural households that rely on motorized transportation more than urban residents.

Cap-and-trade poses equity problems as well, depending on how it is designed. The European Union's Emission Trading Scheme is criticized for exempting transportation, the largest contributor to carbon emissions in Europe. But even within the nonexempt, the allocation of emission quotas has posed equity issues. For example, is it fair to grandfather existing emitters? While this is a massive giveaway to them, existing emitters are also disadvantaged by sunk costs and cannot change production processes quickly if all emission quotas are auctioned (Goulder 2013).

California's cap-and-trade program has introduced a new dimension to the equity debate. Because it establishes emission quotas at the firm level (as opposed to the facility level) and allows trading, firms could create pollution hot spots by concentrating carbon emissions in specific facilities. In a repeat of the EJ story, Cushing et al. (2016) find that these facilities tend to be located near communities of color. Because carbon emissions co-occur with pollutants, such as fine particles, nitrogen oxides, and sulfur dioxide, pollution concentration increases health burdens on these communities, even as California reduces its carbon emissions. However, using a model to account for both facility emissions and their dispersal by air flows, Hernandez-Cortes & Meng (2020) find that California's cap-and-trade program reduced the air pollution gap between disadvantaged and other communities during the time period 2013–2017.

Just Transition

Mitigation policies have another equity dimension: imposing economic, ecological, and health costs on fossil fuel–dependent sectors. Climate regulations, divestment campaigns, and activists' pressure on banks not to fund fossil fuel projects create so-called stranded assets: assets that become unproductive before the end of their economic life. This puts enormous financial pressure on fossil fuel firms and could lead to their bankruptcy (van der Ploeg & Rezai 2020). What are the costs of these bankruptcies, and who bears them? Typically, the local community in which the facility is located and the workers shoulder much of the cost. Bankrupt companies can legally evade some responsibilities. Take the example of coal mine reclamation, which coal companies are legally obliged to undertake once the mine is exhausted. While governments require coal companies to post reclamation bonds (which, to begin with, tend to be inadequate to the scale of the problem; Savage 2021), legal loopholes allow them to skirt these commitments. Thus, bankrupt companies close down, leaving communities with unreclaimed, polluted mines (Macey & Salovaara 2019). These companies sometimes get rid of their pension obligations as well. Job and pension losses hurt local commerce and government revenue. Morris et al. (2021) find that coal-dependent counties could lose almost 20% of their revenue with decarbonization policies.[6]

Policies inspired by "embedded environmentalism" (Dolšak & Prakash 2016) and "just transition" (Newell & Mulvaney 2013, Stevis & Felli 2015, Carley & Konisky 2020) can help address the justice challenges. Like climate mitigation, free-trade policies concentrate costs on specific sectors to generate nonexcludable benefits such as an increase in consumer welfare. Ruggie (1982) suggests that, to secure support for free trade, governments provided safety nets to sectors hurt by imports. Arguably, compensation policies to reduce the economic costs borne by fossil fuel communities should accompany climate mitigation. This is the crux of embedded environmentalism or just transition. The compensation policies could include funding for infrastructure development, job retraining, tax incentives for companies to establish facilities in these areas, pension guarantees and health care support, and so forth. Both US President Biden and the European Union emphasize the importance of tying climate mitigation to just transition. Moreover, environmental and labor coalitions such as the BlueGreen Alliance and the National Economic Transition Platform are now advocating that climate action must accompany policies to reskill, reequip, and revitalize fossil fuel communities (Bergquist et al. 2020, Gaikwad et al. 2021).

The just transition issue is relevant in the international context as well. Foreign direct investment in many African countries, such as Angola, Ghana, Namibia, Nigeria, South Africa, Tanzania, and Zambia, focuses on fossil fuel sectors (Frynas & Paulo 2007). Climate mitigation means that these countries cannot exploit these resources as well as deal with stranded assets, many of which were financed by overseas loans. Even if these countries were to generate renewable energy, it would not replace the foreign exchange they earn by selling fossil fuels. Thus, decarbonization could cause major economic and political upheavals in these countries.

The issue of just transition echoes in still other contexts. Take the case of the ongoing conflict between farmers and native nations regarding the use of the Klamath River in Oregon. Native nations want the river to have plentiful water even during drought conditions because it is critical for the salmon run. Because their rights have legal protection, the federal government is intervening on their behalf. Farmers, however, would like the Bureau of Reclamation, which manages river flows, to ensure that farmers have sufficient water to irrigate their crops. Without water, crops will not survive. This is a perplexing case of CJ because both farmers and the tribes are victims of a prolonged drought, and neither bears a disproportionate responsibility for climate change. Water conflicts are now visible within (Lim & Prakash 2020) and across countries because water tends to be a shared resource with multiple users (Hummel 2017, Conca & Weinthal 2018, Broad & Cavanagh 2021). How such conflicts will be resolved depends on the specific context. Policies such as phasing out water-intensive industrial activities and crops, introducing drought-resistant crops, and rational water pricing can undoubtedly help. However, policy changes such as water pricing invite a backlash, especially from farmers who feel unjustly targeted. Intracountry and cross-border water issues are probably among the most explosive triggers for future conflict (Zeitoun et al. 2020).

[6]We have adopted the causal responsibility principle to evaluate justice issues. What if those who bear historical responsibility no longer have the ability to pay for mitigation? Should the Appalachian coal communities pay for mitigation because they benefited from the fossil economy historically? For reference, the Appalachian Regional Commission classifies 78 counties (of the 420 counties it serves) as distressed: that is, they are among the poorest tenth percentile in the country (ARC 2021). Appalachia is the case where ability to pay should dominate the causality principle. Political wisdom lies in compensating Appalachia for the costs it bears for decarbonization, instead of penalizing for it.

Electric Vehicles, Critical Minerals, and Global Supply Chains

Decarbonization will create demand for electric cars, solar panels, and wind turbines, which require minerals such as lithium, nickel, cobalt, copper, and manganese. The International Energy Agency (IEA 2021) projects that the demand for lithium (critical for EV batteries) could grow 40-fold by 2040. Similarly, the demand for graphite, cobalt, and nickel could increase 20-fold. The problem is that these minerals are geographically concentrated in specific countries, even more so than oil or natural gas. For example, the Democratic Republic of the Congo supplies approximately 70% of the world's cobalt, while Chile supplies around 30% of global copper.

Environmental groups sometimes convey conflicting messages about their commitment to prioritizing emission reductions over other goals. In some cases, environmental groups oppose new mining projects that are crucial to meeting the zero-emission targets. Nevada's Thacker Pass lithium project illustrates the tension between climate and biodiversity objectives. Lithium is a critical mineral for EV batteries. Where will it come from? The opposition to domestic mining will probably lead the United States to source lithium (or EV batteries themselves) from abroad. The Bureau of Land Management has approved the Thacker Pass lithium mine. Still, environmental groups have brought an injunction to stop it because this area is the winter habitat of the sage grouse. Thus, critical mineral sourcing seems to be following the EJ template of pollution havens, whereby rich countries will fulfill the requirements for "dirty" but critical minerals from abroad.

The sourcing of minerals such as lithium from abroad would be less problematic from a CJ perspective if countries facing a potential resource boom had appropriate regulatory institutions in place to manage the environmental and social impacts of mining, along with appropriate policies to employ the new wealth to provide for public goods (Deberdt & Le Billon 2021). Thus, CJ requires an internationally recognized mineral sourcing policy to ensure that the resource boom does not destabilize mining countries or create severe pollution problems. Otherwise, decarbonization could lead to renewed conflict, a type of resource curse (Ross 2015). Moreover, beyond its pollution impact, mining could cause other types of damages. For example, lithium mining is water intensive. Sometimes, when lithium mines are located in water-scarce areas (as they are in Bolivia), lithium mining companies extract water from aquifers and create water scarcity in the neighboring communities (Liu & Agusdinata 2020), potentially sparking violent conflicts.[7]

BENEFITS OF CLIMATE MITIGATION AND ADAPTATION

EJ scholars have focused on uneven exposure to environmental risks. CJ debates also include uneven distribution of the benefits of mitigation and adaptation in ways that reproduce existing inequalities. Take the case of subsidies to early adopters of decarbonization technologies. Research suggests that, all else equal (such as spatial, cultural, and demographic factors), wealthy households tend to be the early adopters (Adams & Kim 2019). But the speed of adoption might be slow, primarily due to the higher up-front costs and risks inherent in most new technologies. To speed up the adoption rates, governments often provide subsidies in the short run. The expectation is that as more households adopt these technologies, economies of scale in production will be activated, and costs will fall. Eventually, subsidies will not be needed because new technologies will become competitive with old technologies, as is happening with solar and wind power in

[7]Similar issues arise in the context of biofuel mandates in developed countries, which creates a boom for products such as palm oil abroad (Vijay et al. 2016). This incentivizes cutting down of forests or converting valuable agricultural land for biofuel crops (Mukherjee & Sovacool 2014).

relation to coal-based electricity (Yang et al. 2020). The literature notes the trade-off between the faster diffusion of low-emission technologies and the fact that wealthy households are the primary beneficiaries of government subsidies in the context of EVs and renewable energy. In this section, we examine each of these aspects of CJ and then examine the inequities in the distribution of benefits of climate adaptation policies.

Subsidies for Electric Vehicles

The transportation sector contributes to approximately 29% of carbon emissions in the United States and approximately 24% globally (Ritchie 2020). Running vehicles on renewable electricity instead of gas or diesel substantially decreases emissions. This is why EVs are an important component of the net-zero-emission strategy. Norway and the Netherlands as well as US states such as California and Washington will ban the sale of new ICEs by 2035.

From the consumer perspective, EV adoption faces two hurdles: The sticker price of EVs is higher than that of ICEs, and there are logistical challenges in charging EVs (as opposed to the convenience of pulling into any gas station to refuel an ICE). To lower the sticker price, governments provide subsidies to either consumers or producers (Wee et al. 2018). In some cases, governments offer additional incentives, such as the use of high-occupancy lanes during rush hour and exemption from new vehicle purchase taxes, road tolls, and parking fees (Jenn et al. 2018).[8]

Who are the EV early adopters benefiting from these subsidies? While the rich tend to be the early adopters, some research suggests that 70% of them would have purchased their EV even without the federal income tax credits. Muehlegger & Rapson (2019) report that households earning less than $100,000 per year represent 72% of ICE purchases but only 44% of EVs. Racial disparities are even more glaring: Blacks and Hispanics account for 41% of the ICE market but only 12% of the EV market. Because EVs tend to have a short driving range, some EV owners need a second car, as data from Norway show (Holtsmark & Skonhoft 2014). Only the more affluent households can afford two cars. In a study of German EV adopters, Plötz et al. (2014) find that affluent middle-aged men in technical professions are likely to be EV purchasers.

Access to charging facilities also drives inequities in EV ownership. EVs need to be charged frequently, depending on the battery size and how much they are driven. Unlike ICE drivers, EV drivers have "range anxiety" for two reasons. First, there are fewer EV charging stations than gas stations. Second, it can take a long time to charge EVs, which means that the number of vehicles that a charging station can process in a day is much smaller. Lee & Clark (2018) estimate that adding 100 driving-range miles to an EV could take 6 min to 26 h of charging, depending on the charging station type and the EV's battery size. Compare this with the few minutes ICE drivers spend in gas stations to fuel up. The long recharging time requires that chargers be located in places where drivers park their cars for extended periods, typically overnight. Four-fifths of EV drivers charge their cars at home, meaning single-family homes or expensive condominiums. Less affluent EV drivers need to rely on public charging stations.

Are public charging stations offsetting the inequitable access to private EV charging? Using American Community Survey data, Hsu & Fingerman (2021) find that census blocks with below-median household incomes and those with Black and Hispanic majority populations tend to have lower access to public charging stations. This accentuates the charging station gap

---

[8] Carbon taxes penalize those who use fossil fuels, and government subsidies reward those who emit less carbon (say, by purchasing energy-efficient appliances). So, why not view EV subsidies in the same way? They are, in effect, negative carbon taxes to compensate EV owners who incur private costs to produce a public good.

because single-family homes have an advantage in both at-home and public charging stations. The implication is that those living in multiunit housing cannot benefit adequately from the EV revolution because of poor access to charging facilities, whether individual or public.

There is another inequity as well. Because EV owners purchase less gasoline, they contribute less to the gasoline tax, which often pays for road maintenance. Davis & Sallee (2020) find that forgone gasoline tax revenue is regressive because, unlike ICEs, EV ownership is concentrated among richer households.

Subsidies for Renewable Energy

Another critical pillar of climate mitigation is the shift from coal and natural gas to renewable energy. Without renewable electricity, the shift from ICE to EVs would not significantly reduce transportation-related emissions. Renewable energy, solar and wind, is typically generated via installing panels on rooftops or by establishing large utility-scale solar or wind farms, typically in rural areas. Distributed solar, which includes individually owned rooftops and solar community projects, account for 38% of solar energy. In contrast, distributed wind accounts for only 1% of wind capacity (EIA 2021).

Equity issues arise in two contexts: in the installation of rooftop solar and in the siting of solar and wind farms. Governments have offered several incentives to promote rooftop solar. Who gets them? As for EVs, the benefits of distributed solar are concentrated among the rich, living in single-family homes.[9] The reason is that rooftop solar electricity is more expensive than electricity a household would receive through the grid. In other words, it does not have socket parity with "regular" electricity (Hagerman et al. 2016). The up-front costs to install solar panels on the roof motivate federal and local governments to subsidize installation costs.

Moreover, rooftop solar is also subsidized via net metering. This means that households producing electricity beyond what they use can sell it back to the utility, typically at the retail price. Consequently, electricity meters run forward when households draw from the grid and run backward when they supply to the grid (Revesz & Unel 2018). Net metering poses an equity problem because rooftop solar households use the electricity grid without paying for grid maintenance (called the network recovery charge), which is included in the per unit charge when a household purchases electricity from the utility. Even when rooftop solar provides a partial replacement for grid electricity, the problem of an implicit subsidy for rooftop solar households remains. After all, the utility needs to keep these households connected to the grid, even when their electricity purchases have gone down (Eid et al. 2014).

Rooftop solar is also supported by feed-in tariffs, which means that the utility purchases all the electricity produced by the household. Instead of one electricity meter, the household has two: one recording the sale to the utility and the other recording its purchase. In theory, feed-in tariffs could address the equity issue by offering a lower rate when households sell electricity to the utility (to defray the grid cost) instead of buying from it. However, in Germany, rooftop solar homes are paid above the market rate. To defray its cost, the government imposes a (regressive) surcharge on all electricity users (Grösche & Schröder 2014).

[9]Are non-White households slower to adopt rooftop solar due to their lower household income and levels of home ownership? Using data from Google's Project Sunroof, Sunter et al. (2019) find that the racial gap in rooftop ownership persists even when income and home ownership are accounted for. This raises questions about the role of noneconomic, sociological drivers in the uneven uptake of decarbonization technologies, an area that CJ scholars should examine in future research.

If households in multidwelling buildings cannot host individual rooftop solar, could community solar help? By subscribing to solar electricity generated by a third party–owned facility, these households gain access to solar energy, reduce their cost, and secure better financing options. To ensure these benefits are available to all, community solar providers must overcome barriers in recruiting low-income households and find ways to finance the project that do not depend on credit scores (Chan et al. 2017).

If the utility company switches over to renewable energy, the debates on rooftop and community solar inequity would be moot. But utility-scale solar (and wind) creates a different equity challenge: private costs and diffused benefits. Typically, these projects are located in rural areas with ample sunshine and wind flow. On the one hand, farmers could benefit from hosting these facilities as they would provide a new source of stable revenue. On the other hand, rural residents increasingly oppose large utility-scale projects (Carlisle et al. 2014). They find that these projects destroy the rural aesthetics and lower property values. Many residents not only object to the noise of wind turbines but also believe that it is wrong to repurpose productive farmland, because a decline in agricultural production could raise the price of food, thereby hurting poor people. Responding to public pressures, many local governments have enacted ordinances regulating the location of the projects and stipulating that there be a buffer between them and residential facilities. Some states—ironically, even Red states, such as Indiana—seek to deny county governments the authority to enact such ordinances. Thus, the facility siting issue that was important in EJ debates has been resurrected in the context of CJ debates. While for EJ debates the protest originated from communities of color, in CJ debates they tend to emanate from White farming communities.

Adaptation Inequities

Communities adopt a wide range of policies to enhance resilience to climate events. Some involve creating hard infrastructures such as seawalls, river embankments, and new water delivery systems. Other approaches involve creating green spaces and planting trees to protect communities from heat waves. Resilience also involves institutional measures such as updating building and fire codes and instituting weatherization policies. Who benefits, and who bears the costs of these policies? For example, if a city issues a bond to finance a seawall, are its benefits shared evenly across the city? Or do they predominantly benefit oceanfront properties? In the case of the Great Wall of Lagos, a seawall was constructed from 100,000 5-ton concrete blocks to protect a planned luxury community, Eko Atlantic, from sea level rise while redirecting seawater to poorer areas (Thomas & Warner 2019).

If a city seeks to create green spaces or plant trees, where are they located? The US Environmental Protection Agency (EPA 2021) notes that trees can lower temperatures by 20–45°F in relation to unshaded areas. Yet, within cities, canopy cover varies by zip code and even within zip codes by census blocks (Hoffman et al. 2020). Non-White neighborhoods tend to have fewer trees and smaller green spaces. It is imperative to reduce the tree canopy gap to make urban resilience more equitable.[10]

Institutional measures to enhance resilience can also distribute benefits unevenly. Suppose a city updates its building codes so that built structures are better able to withstand extreme weather events. Fire prevention requires collective efforts: A single house cannot protect itself

[10]While adapting to urban heat waves certainly merits attention, how farm workers can be protected from heat waves remains a neglected issue. In the United States, about two thirds of agriculture work is performed by farm workers (as opposed to farmers). Yet, there is no federal heat standard governing agricultural work. Heat-related deaths among farmworkers are 20 times that of workers in other occupations (CDC 2008).

from wildfires if others in the community are not participating in fire safety efforts. Yet, fire safety efforts are expensive. While all households benefit, poor households bear disproportionate costs of, say, upgrading to new building codes. This means that, to ensure that adaptation benefits are shared equitably, governments will need to assist poorer families so that their properties can also benefit from adaptation policies.

Enhancing resilience in the agricultural sector also faces equity challenges. Suppose that adaptation entails adopting new cropping patterns and irrigation technologies. This is probably urgently required, especially in water-scarce regions that grow water-intensive crops, much of it for export markets. In effect, these regions export "virtual water" (Allan 1998), a commodity they need to safeguard zealously. With trade liberalization, agricultural products are now embedded in global value chains. Rosa et al. (2019) report that, globally, approximately 52% of the water used in the agricultural sector is unsustainable. Exported crops account for about one-third of unsustainable irrigation water consumption in Mexico, Spain, Turkmenistan, South Africa, Morocco, and Australia.

Climate change is causing prolonged droughts, which pose problems for recharging water aquifers. To adapt, governments may decide to ban the export of water-intensive crops or discourage their planting. They may also seek to levy water charges or regulate the use of aquifers. But these adaptation policies impose concentrated costs because farmers might find it difficult to switch over to new crops or absorb higher water costs. Thus, adaptation policies might hurt farmers and the labor force they employ, leading to conflicts over water sharing arrangements.

Inequities in Disaster Response

Disaster management and recovery form a crucial pillar of climate adaptation. But these policies may show considerable biases, mirroring existing inequalities. Consider the National Flood Insurance Program (NFIP), which provides flood insurance to US homeowners, and the Federal Emergency Management Agency (FEMA), which coordinates the US government's response to natural disasters. Who benefits from NFIP? Approximately one-quarter of NFIP-insured coastal structures are vacation properties owned by the rich. NFIP determines insurance premiums on the basis of floodplain maps (drawn by FEMA), reflecting the varying risks from flooding. Pralle (2019) notes that equity issues extend to drawing floodplain maps. She finds that in the context of Syracuse, New York, wealthy households influence flood zone maps so that their property is assessed at a lower risk level, resulting in lower insurance premiums.

Disaster preparedness is a crucial element of disaster management. Instead of building seawalls or raising river embankments to enhance disaster preparedness, many scholars advocate accommodating water via managed retreats, whereby governments purchase properties and allow them to be flooded. Sometimes governments may condemn properties, as opposed to relying on voluntary retreats. Siders (2019) notes that FEMA-funded buyout programs target poor households because they have lower property values. But forced retreats inflict substantial costs. As families move out, communities disperse and social networks are lost. Moreover, the buyout monies FEMA provides often do not cover the purchase price of comparable new dwellings. In effect, federal disaster management accentuates inequalities (Howell & Elliott 2018).

CONCLUSION

There is overwhelming consensus about the science of climate change. Climate politics, however, remain volatile, driven by perceptions of injustice, which motivate policy resistance and undermine policy legitimacy. Given the massive restructuring that a zero-emission economy will entail, climate change poses enormous governance challenges. Communities tied to the fossil fuel economy are mobilizing to oppose or delay climate action. Low-income households oppose a carbon tax because it imposes a substantial burden on their budgets. Social justice groups oppose EV subsidies because richer and whiter communities corner them. Rural communities oppose siting utility-scale solar and wind farms in their backyards. Communities in the vicinity of new lithium, copper, cobalt, and nickel mines will probably join the opposition. These instances of policy opposition reflect a shared concern: Climate policy is unfair because specific communities either are shouldering high costs or are not benefiting sufficiently from decarbonization or adaptation. Perceptions of injustice raise questions about the win-win narrative, which suggests that the decarbonized economy will tackle climate change and jump-start the new economy.

Our review has focused on the distribution of climate impacts and the costs and benefits of climate policies. Might mitigation and adaptation create cobenefits that reduce or enhance these inequities? Although rich households benefit disproportionately from rooftop solar subsidies, what if solar energy helps displace coal, which reduces air pollution faced by disadvantaged families living near coal facilities? Similar dynamics are in play for EVs. Communities living near highways are exposed disproportionately to air pollution. If EVs were to replace ICEs, this pollution would decrease, creating important health benefits for these communities. Future research should examine how short-term inequities favoring the rich could be made politically more acceptable in the light of long-term health benefits that decarbonized technologies will provide to underprivileged communities.

This review has not addressed intergenerational (Gardiner 2006) or interspecies (Kopnina et al. 2018) equity issues. Both raise important questions about how to address the concerns of actors who do not have a seat at the policy table. Recent court cases, especially *Juliana v. United States* (2020), have sparked an important debate on whether current generations should use the atmosphere as if they were its trustees. Otherwise, by overusing it, they are creating intergenerational externalities. One approach could be to examine the discount rate employed in calculating the social cost of carbon so that the concerns of future generations could be better addressed.

Yet, intergenerational justice issues are complex. While future generations certainly would want a stable climate, some might prioritize economic development (Hayward 2007). Preferences for forgoing development today to secure climate benefits tomorrow will probably vary significantly across countries. Future generations in developing countries that have invested in oil and gas probably would not appreciate being saddled with stranded assets from aggressive decarbonization. Those who are struggling to survive in the present probably do not have the luxury of sacrificing their current opportunities to defend the rights of future generations.

Scholars also debate anthropocentrism in climate policy (Hayward 1997), the assumption that the value of any climate action (in terms of its costs and benefits) should be evaluated from the human perspective only. What if decarbonization leads to the loss of biodiversity? Many countries are confronting the issue of how to strike a balance between wildlife protection and renewable energy (Gasparatos et al. 2017). In California's Mojave Desert, environmentalists have brought court injunctions to stop solar farms that they believe will destroy Joshua trees. India's western border areas have an excellent potential for wind and solar energy, but they also serve as the habitat for the great Indian bustard, a species protected under the 1972 Wild Life Protection Act. Because these birds have crashed into power lines, India's Supreme Court has asked renewable power companies to bury the power lines underground. This raises transmission costs and makes renewable energy less competitive. The ongoing challenges to renewable energy projects are rooted in existing laws to protect endangered species or procedural issues such as environmental impact assessment. The broader and more complex issue of anthropocentrism has yet to be tested in courts. We believe the future CJ debate should examine the pros and cons of expanding the ambit of legitimate stakeholders to examine equity in climate policy.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

ACKNOWLEDGMENTS

We thank Dustin Tingley for excellent comments on the previous draft.

LITERATURE CITED

Adams B, Kim H. 2019. Early adopters of new supermarket products. *Appl. Econ. Lett.* 26(14):1196–201

Ajibade I, Sullivan M, Haeffner M. 2020. Why climate migration is not managed retreat: six justifications. *Glob. Environ. Change* 65:102187

Aklin M, Mildenberger M. 2020. Prisoners of the wrong dilemma: why distributive conflict, not collective action, characterizes the politics of climate change. *Global Environ. Politics* 20(4):4–27

Allan JA. 1998. Virtual water: a strategic resource. *Ground Water* 36(4):545–47

Anguelovski I, Shi L, Chu E, Gallagher D, Goh K, et al. 2016. Equity impacts of urban land use planning for climate adaptation: critical perspectives from the global north and south. *J. Plan. Educ. Res.* 36(3):333–48

ARC (Appalach. Reg. Comm.). 2021. *Classifying economic distress in Appalachian counties*. Vis. Statement, ARC, Washington, DC. **https://www.arc.gov/classifying-economic-distress-in-appalachian-counties/**

Barrett S. 2013. Local level climate justice? Adaptation finance and vulnerability reduction. *Glob. Environ. Change* 23(6):1819–29

Baumol W, Oates W. 1988. *The Theory of Environmental Policy*. Cambridge, UK: Cambridge Univ. Press. 2nd ed.

Bergquist P, Mildenberger M, Stokes L. 2020. Combining climate, economic, and social policy builds public support for climate action in the US. *Environ. Res. Lett.* 15(5):054019

Broad R, Cavanagh J. 2021. *The Water Defenders: How Ordinary People Saved a Country from Corporate Greed*. New York: Beacon

Brooks D, Hoberg E, Boeger W. 2019. *The Stockholm Paradigm: Climate Change and Emerging Disease*. Chicago: Univ. Chicago Press

Brunnermeier S, Levinson A. 2004. Examining the evidence on environmental regulations and industry location. *J. Environ. Dev.* 13(1):6–41

Bullard R. 1990. *Dumping in Dixie: Race, Class and Environmental Quality*. Boulder, CO: Westview

Bullard R, Johnson G. 2000. Environmental justice: grassroots activism and its impact on public policy decision making. *J. Soc. Issues* 56:555–78

Burkett M. 2011. In search of refuge: Pacific Islands, climate-induced migration, and the legal frontier. *Asia Pac. Issues* 98:1–8

Carley S, Konisky D. 2020. The justice and equity implications of the clean energy transition. *Nat. Energy* 5:569–77

Carlisle J, Kane S, Solan D, Joe JC. 2014. Support for solar energy: examining sense of place and utility-scale development in California. *Energy Res. Soc. Sci.* 3:124–30

Carr E, Thomson M. 2014. Gender and climate change adaptation in agrarian settings. *Geogr. Compass* 8(3):182–97

Castellano R, Dolsak N, Prakash A. 2021. Willingness to help climate migrants: a survey experiment in the Korail slum of Dhaka, Bangladesh. *PLOS ONE* 16(4):e0249315

CDC (Cent. Dis. Control Prev.). 2008. Heat related deaths among crop workers—United States, 1992–2006. *Morb. Mortal. Wkly Rep.* 57:1–5

Chan G, Evans I, Grimley M, Ihde B, Mazumder P. 2017. Design choices and equity implications of community shared solar. *Electr. J.* 30(9):37–41

Conca K, Weinthal E, eds. 2018. *The Oxford Handbook of Water Politics and Policy*. Oxford, UK: Oxford Univ. Press

Crow B, Sultana F. 2002. Gender, class, and access to water: three cases in a poor and crowded delta. *Soc. Nat. Resour.* 15(8):709–24

Cushing L, Wander M, Morello-Frosch R, Pastor M, Zhu A, Sadd J. 2016. *A preliminary environmental equity assessment of California's cap and trade program*. Res. Brief, USC Dornsife, Los Angeles. **https://dornsife.usc.edu/PERE/enviro-equity-CA-cap-trade**

Davis L, Sallee J. 2020. Should electric vehicle drivers pay a mileage tax? *Environ. Energy Policy Econ.* 1(1):65–94

Deberdt R, Le Billon P. 2021. Conflict minerals and battery materials supply chains: a mapping review of responsible sourcing initiatives. *Extr. Ind. Soc*. 8:100935

Dolšak N, Adolph C, Prakash A. 2020. Policy design and public support for carbon tax: evidence from a 2018 US national online survey experiment. *Public Adm.* 98(4):905–21

Dolšak N, Prakash A. 2015. Confronting the "China excuse": the political logic of climate change adaptation. *Solutions* 6:27–29

Dolšak N, Prakash A. 2016. We feel your pain: environmentalists, coal miners, and "embedded environmentalism." *Solutions* 7:32–37

Dolšak N, Prakash A. 2018. The politics of climate change adaptation. *Annu. Rev. Environ. Resour.* 43:317–41

EIA (US Energy Inf. Adm.). 2021. *Electricity explained: electricity generation, capacity, and sales in the United States*. Fact Sheet, EIA, Washington, DC. **https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php**

Eid C, Guillén J, Marín P, Hakvoort R. 2014. The economic effect of electricity net-metering with solar PV: consequences for network cost recovery, cross subsidies and policy objectives. *Energy Policy* 75:244–54

EPA (US Environ. Prot. Agency). 2017. *Environmental justice timeline*. Timeline, EPA, Washington, DC. **https://www.epa.gov/environmentaljustice/environmental-justice-timeline**

EPA (US Environ. Prot. Agency). 2021. *Using trees and vegetation to reduce heat islands*. Environ. Top., EPA, Washington, DC. **https://www.epa.gov/heatislands/using-trees-and-vegetation-reduce-heat-islands**

Farrell N, Lyons S. 2016. Equity impacts of energy and climate policy: Who is shouldering the burden? *Wiley Interdiscip. Rev. Energy Environ.* 5(5):492–509

Fruh K. 2021. Climate change driven displacement and justice: the role of reparations. *Essays Philos*. 22(1/2):102–21

Frynas J, Paulo M. 2007. A new scramble for African oil? Historical, political, and business perspectives. *Afr. Aff.* 106(423):229–51

Gaikwad N, Genovese F, Tingley D. 2021. *Climate action from abroad: assessing mass support for cross-border climate compensation*. Work. Pap., Harvard Univ., Cambridge, MA

Gardiner S. 2006. A perfect moral storm: climate change, intergenerational ethics and the problem of moral corruption. *Environ. Values* 15(3):397–413

Gasparatos A, Doll C, Esteban M, Ahmed A, Olang T. 2017. Renewable energy and biodiversity: implications for transitioning to a Green Economy. *Renew. Sustain. Energy Rev.* 70:161–84

Gonzalez F. 2012. Distributional effects of carbon taxes: the case of Mexico. *Energy Econ*. 34(6):2102–15

Gosseries A. 2004. Historical emissions and free riding. *Ethical Perspect*. 11:36–60

Goulder L. 2013. Markets for pollution allowances: What are the (new) lessons? *J. Econ. Perspect.* 27(1):87–102

Greenhill B, Dolšak N, Prakash A. 2018. Exploring the adaptation–mitigation relationship: Does information on the costs of adapting to climate change influence support for mitigation? *Environ. Commun.* 12(7):911–27

Grösche P, Schröder C. 2014. On the redistributive effects of Germany's feed-in tariff. *Empir. Econ.* 46:1339–83

Guo S, Kontou E. 2021. Disparities and equity issues in electric vehicles rebate allocation. *Energy Policy* 154:112291

Gupta J. 2009. Climate change and development cooperation: trends and questions. *Curr. Opin. Environ. Sustain.* 1(2):207–13

Hagerman S, Jaramillo P, Morgan M. 2016. Is rooftop solar PV at socket parity without subsidies? *Energy Policy* 89:84–94

Harper K, Rajan R. 2007. International environmental justice: building the natural assets of the world's poor. In *Reclaiming Nature: Environmental Justice and Ecological Restoration*, ed. JK Boyce, S Narain, EA Stanton, pp. 327–50. London: Anthem

Hayward T. 1997. Anthropocentrism: a misunderstood problem. *Environ. Values* 6(1):49–63

Hayward T. 2007. Human rights versus emissions rights: climate justice and the equitable distribution of ecological space. *Ethics Int. Aff.* 21(4):431–50

Helbling M. 2020. Attitudes towards climate change migrants. *Clim. Change* 160:89–102

Hernandez-Cortes D, Meng K. 2020. *Do environmental markets cause environmental injustice? Evidence from California's carbon market*. NBER Work. Pap. 27205

Hoffman J, Shandas V, Pendleton N. 2020. The effects of historical housing policies on resident exposure to intra-urban heat: a study of 108 US urban areas. *Climate* 8(1):12

Holtsmark B, Skonhoft A. 2014. The Norwegian support and subsidy policy of electric cars. Should it be adopted by other countries? *Environ. Sci. Policy* 42:160–68

Howell J, Elliott JR. 2018. As disaster costs rise, so does inequality. *Socius* 4(2018):2378023118816795

Hsu C, Fingerman K. 2021. Public electric vehicle charger access disparities across race and income in California. *Transp. Policy* 100:59–67

Hummel S. 2017. Relative water scarcity and country relations along cross-boundary rivers: evidence from the Aral Sea basin. *Int. Stud. Q.* 61(4):795–808

IEA (Int. Energy Agency). 2021. *The role of critical minerals in clean energy transitions*. Flagship Rep., IEA, Paris. **https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions**

IHS Markit. 2020. *Average age of cars and light trucks in the U.S. approaches 12 years*. News Release, July 28, IHS Markit, London. **https://news.ihsmarkit.com/prviewer/release_only/slug/bizwire-2020-7-28-average-age-of-cars-and-light-trucks-in-the-us-approaches-12-years-according-to-ihs-markit**

Jenkins K. 2018. Setting energy justice apart from the crowd: lessons from environmental and climate justice. *Energy Res. Soc. Sci.* 39:117–21

Jenn A, Springel K, Gopal A. 2018. Effectiveness of electric vehicle incentives in the United States. *Energy Policy* 119:349–56

Johnson T. 2019. The Dakota Access pipeline and the breakdown of participatory processes in environmental decision-making. *Environ. Commun.* 13(3):335–52

Juliana v. United States, 947 F.3d 1159 (9th Cir. 2020)

Klinsky S, Dowlatabadi H. 2009. Conceptualizations of justice in climate policy. *Clim. Policy* 9(1):88–108

Kolstad C, Urama K, Broome J, Bruvoll A, Carino Olvera M, et al. 2014. Social, economic and ethical concepts and methods. In *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. O Edenhofer, R Pichs-Madruga, Y Sokona, E Farahani, S Kadner, et al., pp. 173–248. Cambridge, UK: Cambridge Univ. Press

Konisky D. 2009. Inequities in enforcement? Environmental justice and government performance. *J. Policy Anal. Manag.* 28(1):102–21

Kopnina H, Washington H, Taylor B, Piccolo J. 2018. Anthropocentrism: more than just a misunderstood problem. *J. Agric. Environ. Ethics* 31(1):109–27

Kraft M, Scheberle D. 1995. Environmental justice and the allocation of risk: the case of lead and public health. *Policy Stud. J.* 23(1):113–22

Laswell H. 1936. *Politics: Who Gets What, When, How*. New York: Meridian

Lee H, Clark A. 2018. *Charging the future: challenges and opportunities for electric vehicle adoption*. Work. Pap. RWP18-026, Kennedy Sch. Gov., Harvard Univ., Cambridge, MA

Li Z, Konisky D, Zirogiannis N. 2019. Racial, ethnic, and income disparities in air pollution: a study of excess emissions in Texas. *PLOS ONE* 14:e0220696

Lim S, Prakash A. 2020. How the opposing pressures of industrialization and democratization influence clean water access in urban and rural areas: a panel study, 1991–2010. *Environ. Policy Gov.* 30(4):182–95

Liu W, Agusdinata D. 2020. Interdependencies of lithium mining and communities sustainability in Salar de Atacama, Chile. *J. Clean. Prod.* 260:120838

Macey J, Salovaara J. 2019. Bankruptcy as bailout: coal company insolvency and the erosion of federal law. *Stanford Law Rev.* 71(4):879

Mohai P, Pellow D, Roberts J. 2009. Environmental justice. *Annu. Rev. Environ. Resour.* 34:405–30
Morris A, Kaufman N, Doshi S. 2021. Revenue at risk in coal-reliant counties. *Environ. Energy Policy Econ.* 2(1):83–116
Muehlegger E, Rapson D. 2019. *Understanding the distributional impacts of vehicle policy: Who buys new and used electric vehicles?* Policy Brief, Inst. Transp. Stud., Univ. Calif., Davis. **https://escholarship.org/uc/item/1q259456**
Mukherjee I, Sovacool B. 2014. Palm oil–based biofuels and sustainability in southeast Asia: a review of Indonesia, Malaysia, and Thailand. *Renew. Sustain. Energy Rev.* 37:1–12
Murray B, Rivers N. 2015. British Columbia's revenue-neutral carbon tax: a review of the latest "grand experiment" in environmental policy. *Energy Policy* 86:674–83
Nardone A, Casey J, Morello-Frosch R, Mujahid M, Balmes J, Thakur N. 2020. Associations between historical residential redlining and current age-adjusted rates of emergency department visits due to asthma across eight cities in California: an ecological study. *Lancet Planet. Health* 4(1):e24–31
Nelson V, Meadows K, Cannon T, Morton J, Martin A. 2002. Uncertain predictions, invisible impacts, and the need to mainstream gender in climate change adaptations. *Gender Dev*. 10(2):51–59
Newell P, Mulvaney D. 2013. The political economy of the 'just transition'. *Geogr. J.* 179(2):132–40
NOAA (Natl. Ocean. Atm. Adm.). 2021. *Future heat events and social vulnerability*. Data Vis., NOAA, Washington, DC. **https://nihhis.cpo.noaa.gov/vulnerability-mapping**
Ostrom E. 2010. Polycentric systems for coping with collective action and global environmental change. *Glob. Environ. Change* 20(4):550–57
Plötz P, Schneider U, Globisch J, Dütschke E. 2014. Who will buy electric vehicles? Identifying early adopters in Germany. *Transp. Res. A* 67:96–109
Posner E, Weisbach D. 2010. *Climate Change Justice*. Princeton, NJ: Princeton Univ. Press
Pralle S. 2019. Drawing lines: FEMA and the politics of mapping flood zones. *Clim. Change* 152:227–37
Revesz R, Unel B. 2018. The future of distributed generation: moving past net metering. *Environ. Law Rep.* 48:10719
Rigaud K, de Sherbinin A, Jones B, Bergmann J, Clement V, et al. 2018. *Groundswell: Preparing for Internal Climate Migration*. Washington, DC: World Bank
Ritchie H. 2020. Cars, planes, trains: Where do CO_2 emissions from transport come from? *Our World in Data Blog*, Oct. 6. **https://ourworldindata.org/co2-emissions-from-transport**
Roberts C. 2014. *EPA existing source emissions rule puts American jobs at risk, does nothing to address climate change*. News Release, June 2, United Mine Work. Am., Triangle, VA. **http://www.ibew.org/Portals/74/Documents/UMWA-Press-Release-on-EPA-Carbon-Emissions.pdf**
Rosa L, Chiarelli D, Tu C, Rulli M, D'Odorico P. 2019. Global unsustainable virtual water flows in agricultural trade. *Environ. Res. Lett.* 14(11):114001
Ross M. 2015. What have we learned about the resource curse? *Annu. Rev. Political Sci.* 18:239–59
Ruggie J. 1982. International regimes, transactions, and change: embedded liberalism in the postwar economic order. *Int. Organ.* 36(2):379–415
Savage E. 2021. *Repairing the damage: the costs of delaying reclamation at modern-era mines*. Rep., Appalachian Voices, Durham, NC. **https://appvoices.org/resources/RepairingTheDamage_ReclamationAtModernMines.pdf**
Schlosberg D, Collins L. 2014. From environmental to climate justice: climate change and the discourse of environmental justice. *Wiley Interdiscip. Rev. Clim. Change* 5(3):359–74
Semenza J, Rubin C, Falter K, Selanikio J, Flanders W, et al. 1996. Heat-related deaths during the July 1995 heat wave in Chicago. *N. Engl. J. Med.* 335(2):84–90
Siders AR. 2019. Social justice implications of US managed retreat buyout programs. *Clim. Change* 152:239–57
Smith E, Mayer A. 2018. A social trap for the climate? Collective action, trust and climate change risk perception in 35 countries. *Glob. Environ. Change* 49:140–53
Sovacool B, Ali S, Bazilian M, Radley B, Nemery B, et al. 2020. Sustainable minerals and metals for a low-carbon future. *Science* 367(6473):30–33
Spilker G, Nguyen Q, Koubi V, Böhmelt T. 2020. Attitudes of urban residents towards environmental migration in Kenya and Vietnam. *Nat. Climate Change* 10(7):622–27

Stanley S, Williamson J. 2021. Attitudes towards climate change aid and climate refugees in New Zealand: an exploration of policy support and ideological barriers. *Environ. Politics.* **https://doi.org/10.1080/09644016.2021.1892982**

Stevis D, Felli R. 2015. Global labour unions and just transition to a green economy. *Int. Environ. Agreem. Politics Law Econ.* 15(1):29–43

Sunter D, Castellanos S, Kammen D. 2019. Disparities in rooftop photovoltaics deployment in the United States by race and ethnicity. *Nat. Sustain.* 2(1):71–76

Terry G. 2009. No climate justice without gender justice: an overview of the issues. *Gend. Dev.* 17(1):5–18

Tessum CW, Apte JS, Goodkind AL, Muller NZ, Mullins KA, et al. 2019. Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure. *PNAS* 116(13):6001–6

Thomas K, Warner B. 2019. Weaponizing vulnerability to climate change. *Glob. Environ. Change* 57:101928

Thorpe R. 2015. Perverse politics: the persistence of mass imprisonment in the twenty-first century. *Perspect. Politics* 13(3):618–37

Tong K, Ramaswami A, Xu C, Feiock R, Schmitz P, Ohlsen M. 2021. Measuring social equity in urban energy use and interventions using fine-scale data. *PNAS* 118(24):e2023554118

Uji A, Prakash A, Song J. 2021. Does the "NIMBY syndrome" undermine public support for nuclear power in Japan? *Energy Policy* 148:111944

van der Ploeg F, Rezai A. 2020. Stranded assets in the transition to a carbon-free economy. *Annu. Rev. Resour. Econ.* 12:281–98

Vijay V, Pimm S, Jenkins C, Smith S. 2016. The impacts of oil palm on recent deforestation and biodiversity loss. *PLOS ONE* 11(7):e0159668

Wee S, Coffman M, La Croix S. 2018. Do electric vehicle incentives matter? Evidence from the 50 US states. *Res. Policy* 47(9):1601–10

Wilson J, ed. 1980. *The Politics of Regulation*. New York: Basic

Yang Y, Campana P, Yan J. 2020. Potential of unsubsidized distributed solar PV to replace coal-fired power plants, and profits classification in Chinese cities. *Renew. Sustain. Energy Rev.* 131:109967

Zeitoun M, Mirumachi N, Warner J. 2020. *Water Conflicts: Analysis for Transformation*. Oxford, UK: Oxford Univ. Press